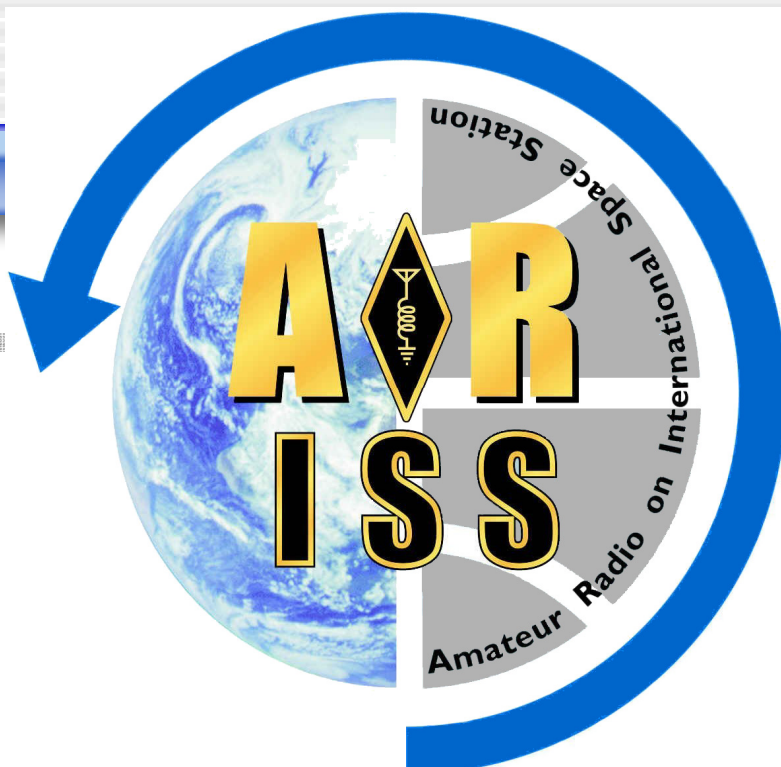




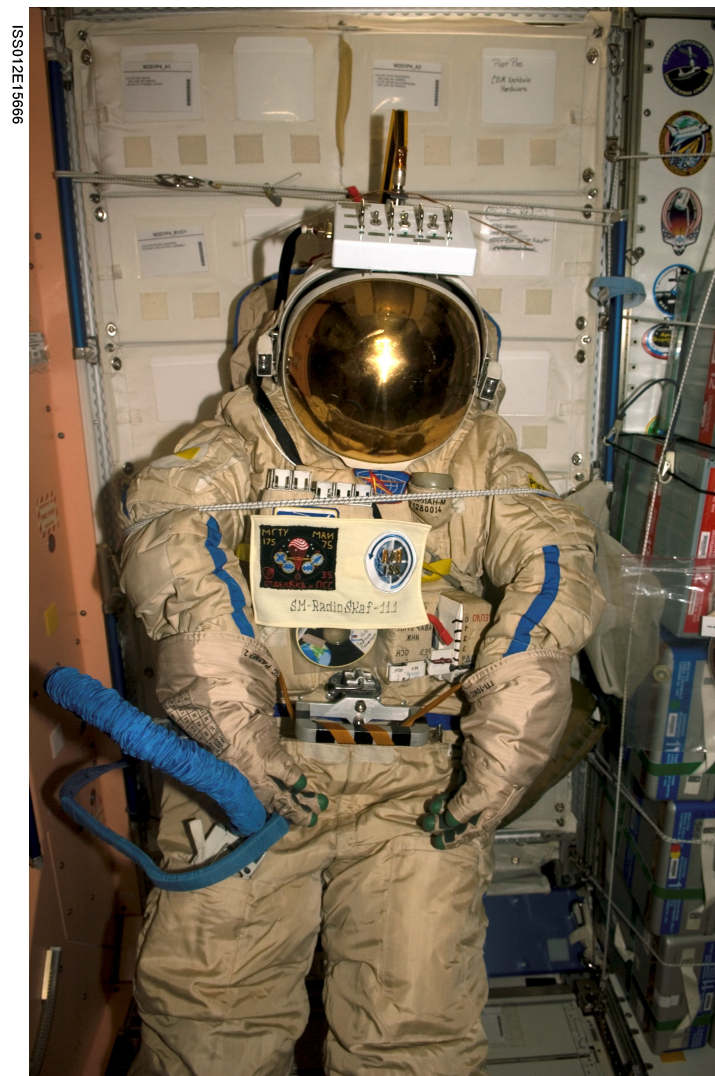
SuitSat-2



Lou McFadin
W5DID
Oct 2008



Suitsat 1 ready for Deployment



ISS012E15666

Lou McFadin W5DID



SuitSat-1 Mission and Capabilities



Primary mission

Voice message Commemorating the 175th Anniversary of Bauman state University Moscow.
This included audio greetings from

Energia, Bauman State University, ARISS Europe, ARISS Canada, ARISS U.S.A.
ARISS Japan

A CD ROM with photos contributed from schools around the world.

Secondary mission

SSTV images of Earth and Station

Amateur operations

Packet ops

Beacon

Earth sensor test data

Gather real space operating data and
experience on several candidate sensors for Eagle.



SuitSat-2 Mission and Capabilities



Primary mission

Voice messages Commemorating (TBD)

This includes audio greetings from

Energia, ARISS Europe, ARISS Canada, ARISS U.S.A. ARISS Japan

A CD ROM with photos contributed from schools around the world.

Secondary Mission

Testbed for systems planned for future Amateur radio satellites

Amateur operations

CW ID

Packet ops

SSB Transponder

FM Cross band repeater

SSTV images of Earth and Station

Experiments (TBD-TSFR)



SuitSat-2 Top Level



- SuitSat-2 will transmit voice messages commemorating historic events as a primary objective.
- A second objective will be to use the suit as a test bed for Amateur Radio satellite operations including packet operations, SSB transponder, FM cross band repeater, SSTV, and the opportunity to fly additional experiments designed by university students. A solar power system will also be used.



The Proposed Plan



- Build upon Suitsat-1 design
- Re-use safety interlock circuit with update for Solar panels
- Transmitter and Receiver module
- IHU Module
- Control Panel same as Suitsat-1
- New Power module for solar panels
- Solar Panels
- Up to Four Experiments
- Four Temperature Sensors
- Up to Four cameras for SSTV



Future Concept Testbed



- Use as a test bed for new concepts for future Amateur radio Satellites.
 - ♦ Satellite power system
 - Max power point converters for solar panel
 - Distributed Converters
 - Distributed Storage system
 - ♦ Software Defined Radio (SDR) Prototype
 - ♦ Additional experiments



SSTV



- SSTV
 - ♦ Four video ports
 - ♦ No power until switched on just before data take.
 - ♦ Four U.S. Supplied Cameras
 - ♦ No blank video
 - Processor examines video and skips if no image present



Experiments



- Experiment ports
 - ♦ Four ports
 - One reserved for MicroChip (Supplier of electronics) non commercial.
 - One Russian
 - Data packets to be 2k Bytes transferred on request from the IHU.



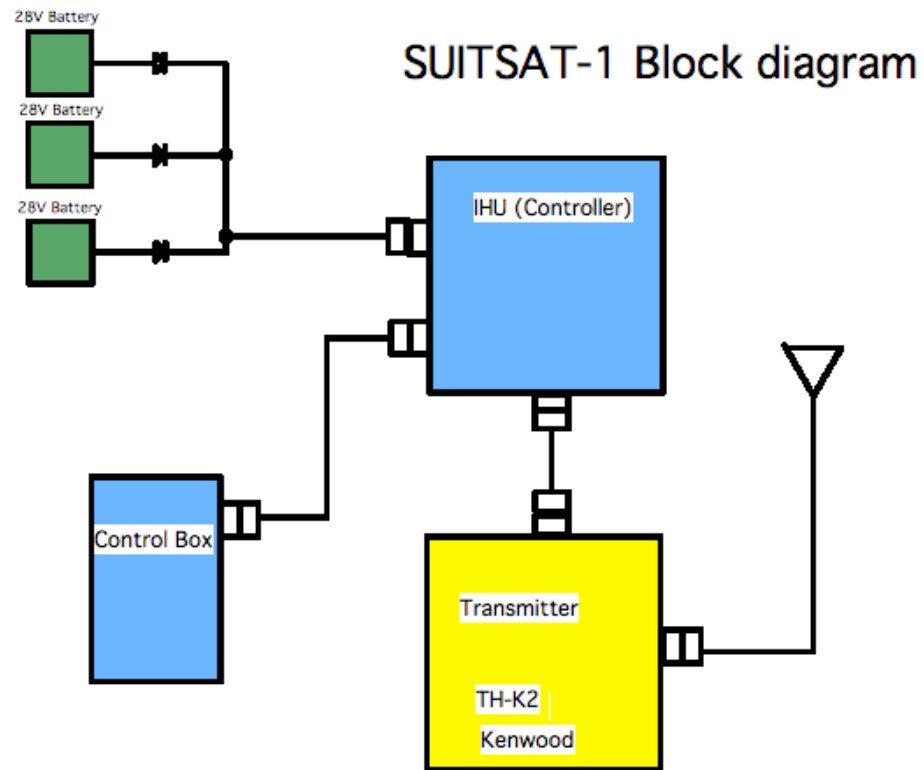
Radio Module



- Radio
 - ◆ SDX(Software Defined Transponder) Eagle prototype capabilities
 - Multimode
 - SSB Crossband (U/V) Transponder repeater with Telemetry beacon
 - FM-FM Cross band (U/V) packet
 - Multiple signals simultaneously

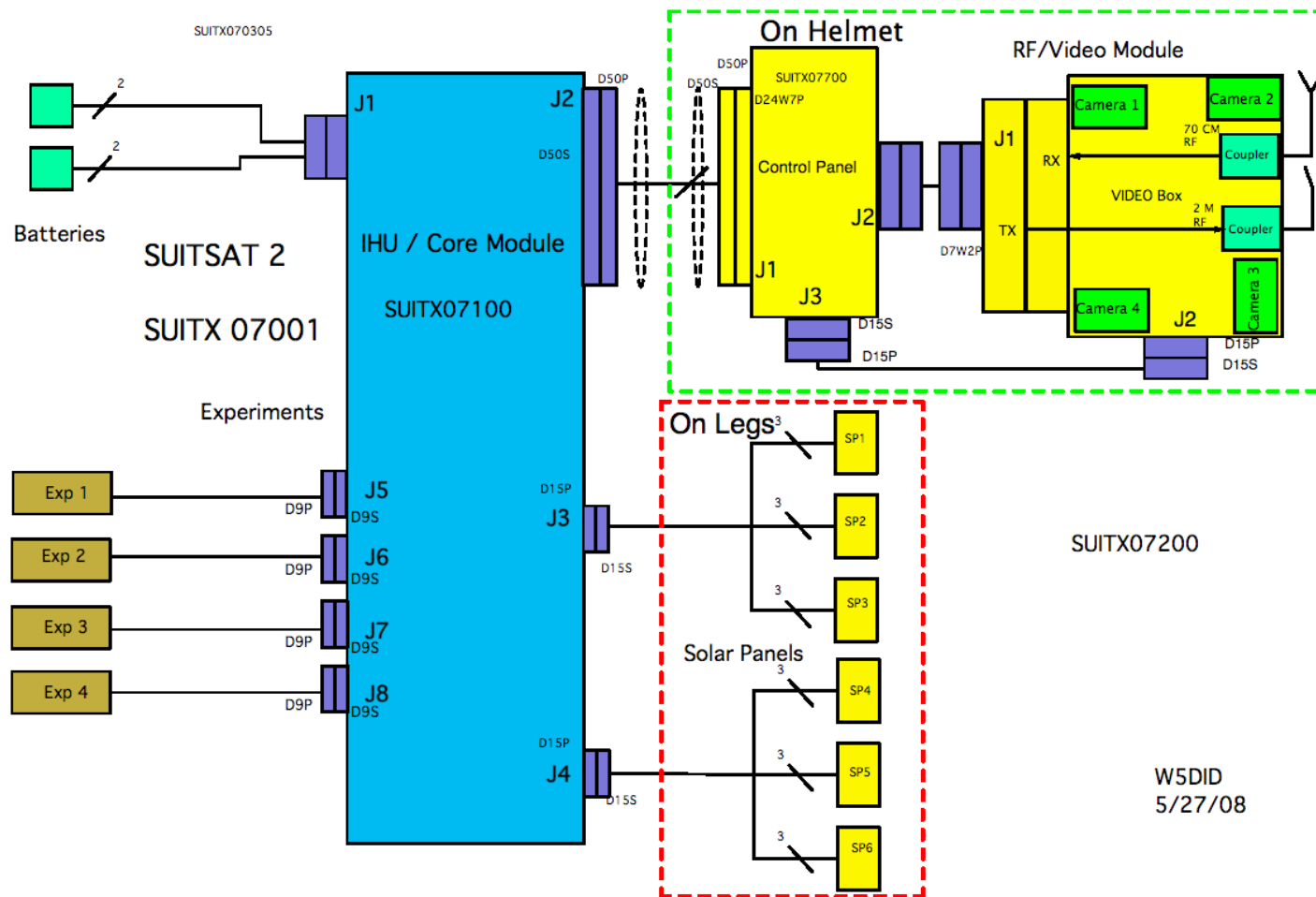


Suitsat-1 Block Diagram





Suitsat 2 Interconnection diagram

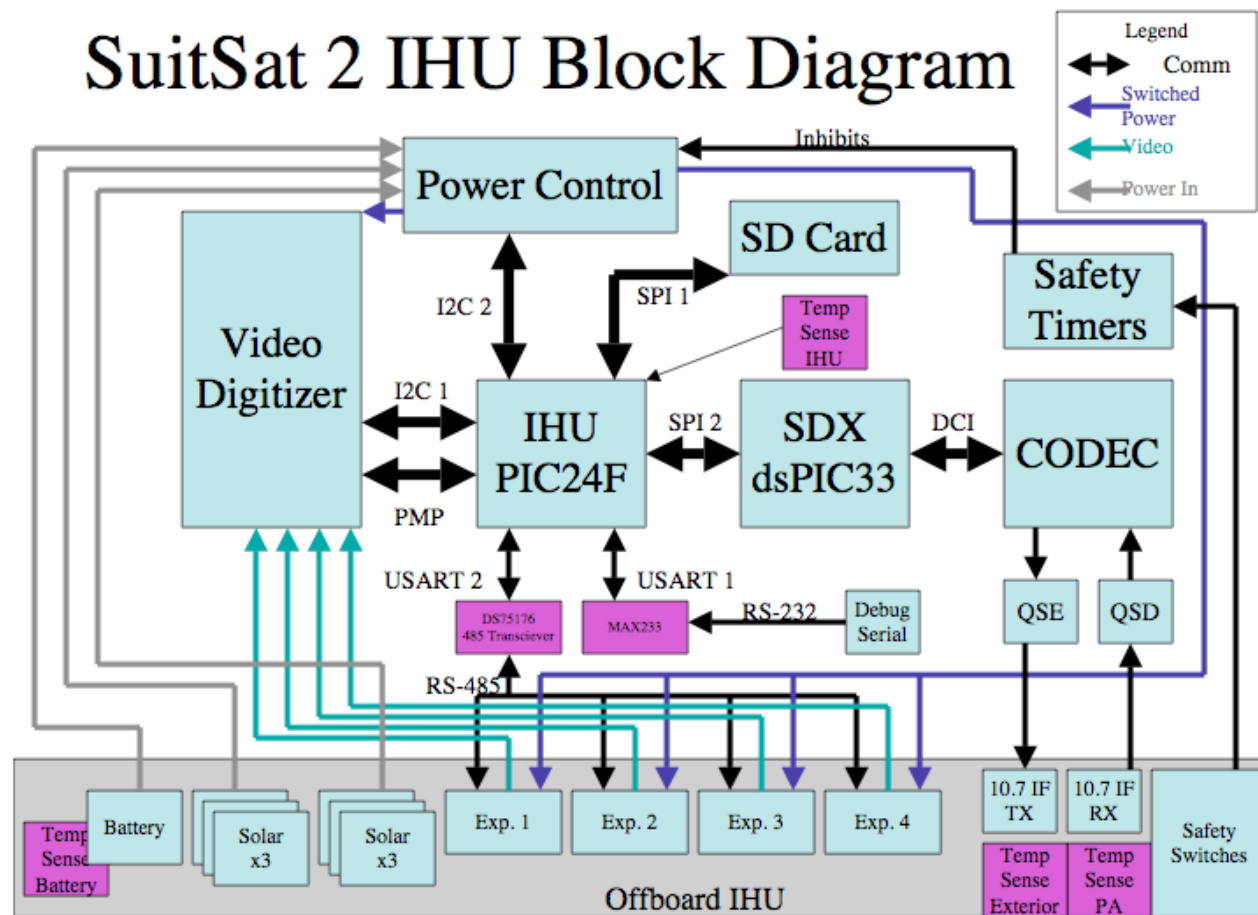




Suitsat 2 System Diagram



SuitSat 2 IHU Block Diagram





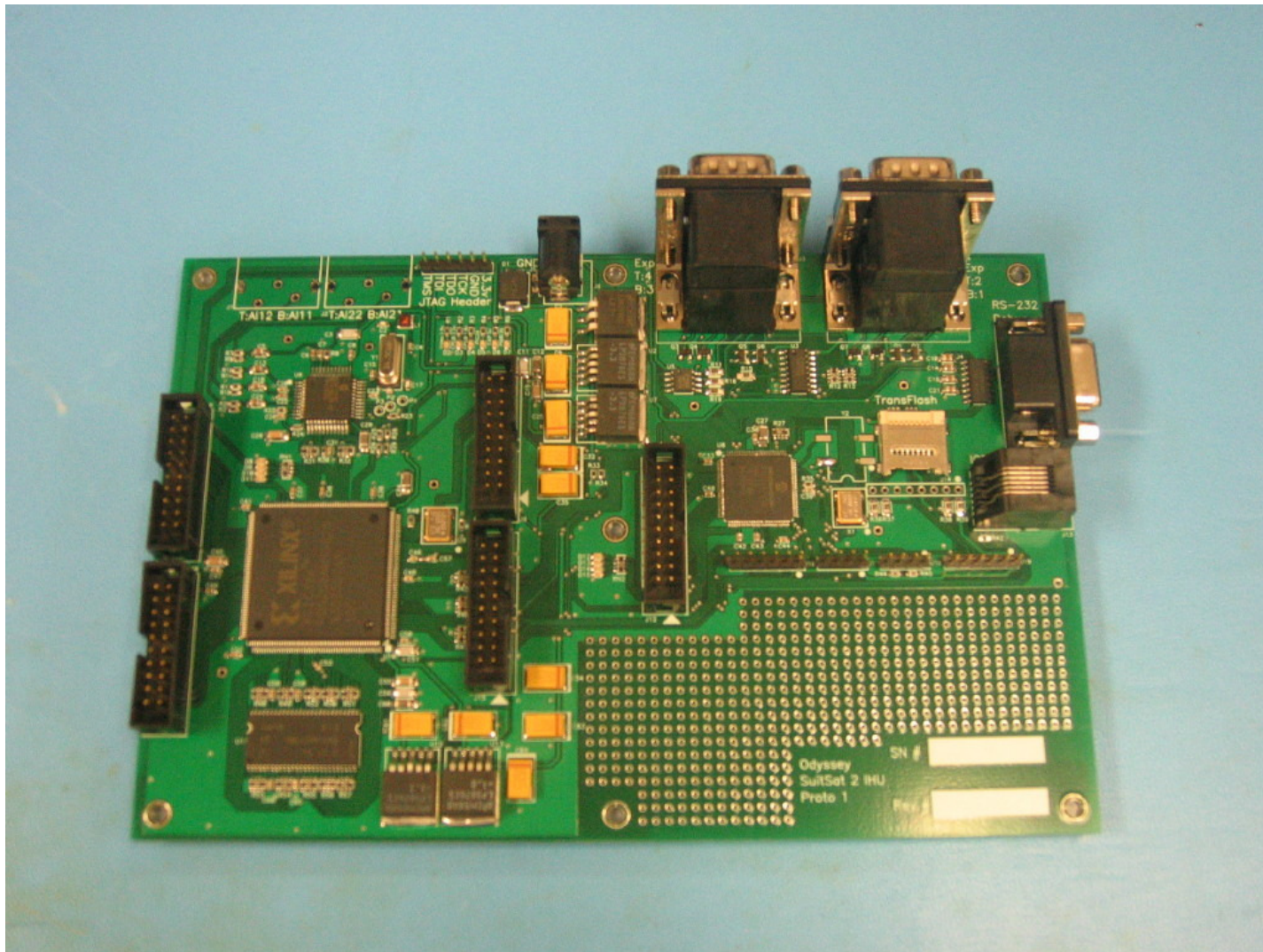
Suitsat 2 Power controller



QuickTime™ and a
TIFF (Uncompressed) decompressor
are needed to see this picture.



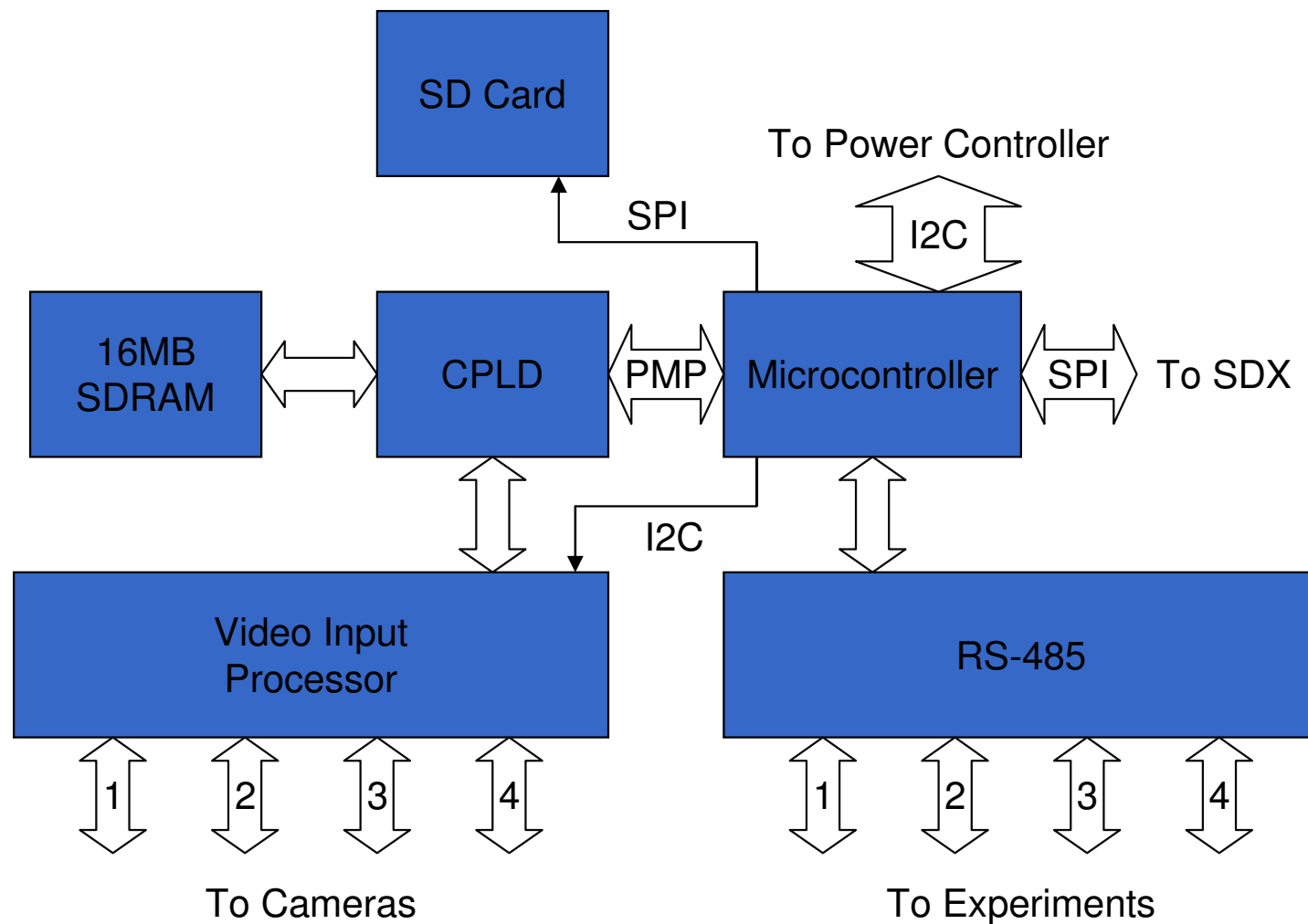
Suitsat 2 IHU and Core Module



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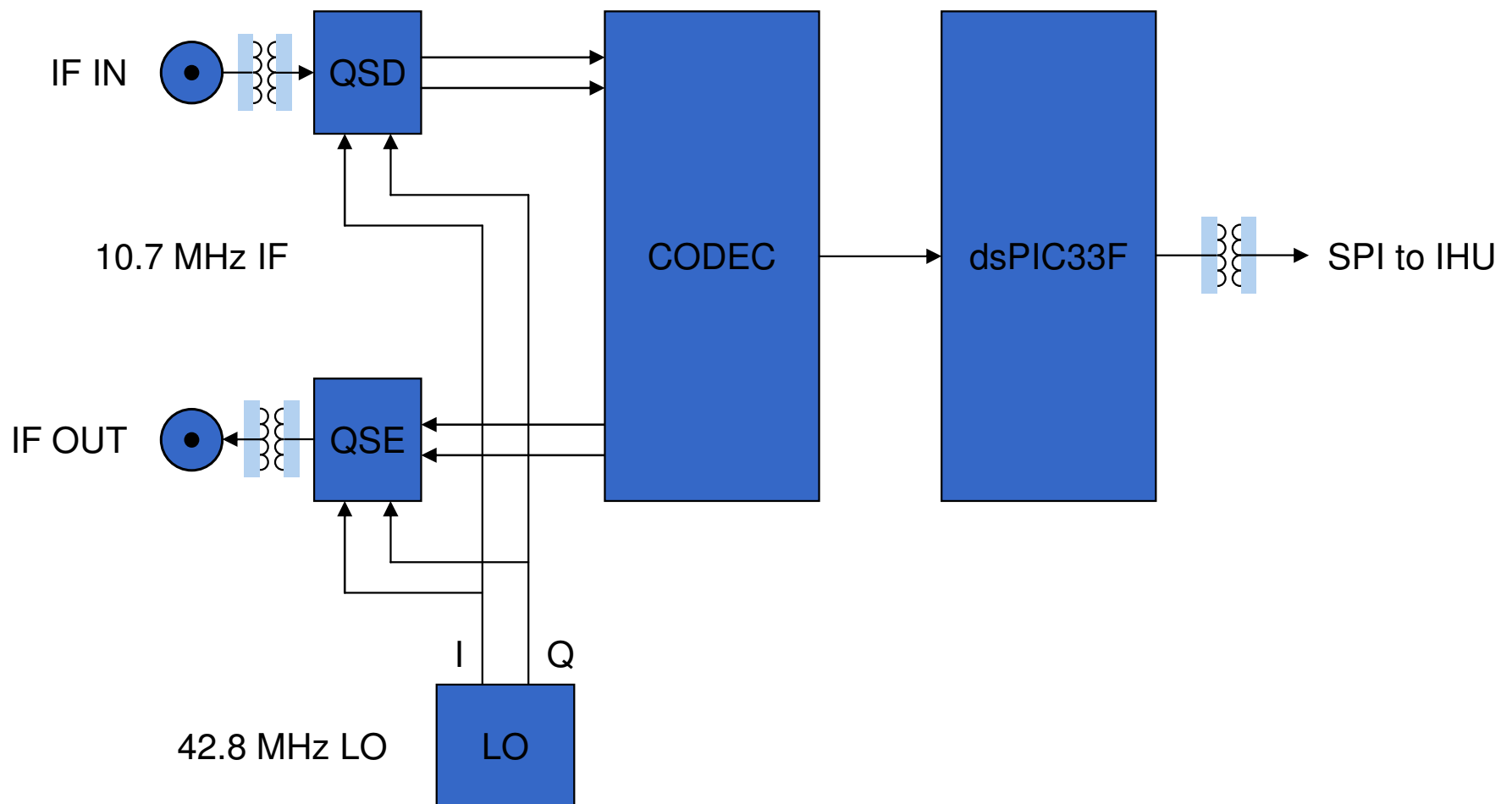


SuitSat-2 Internal Housekeeping Unit (IHU) Block Diagram



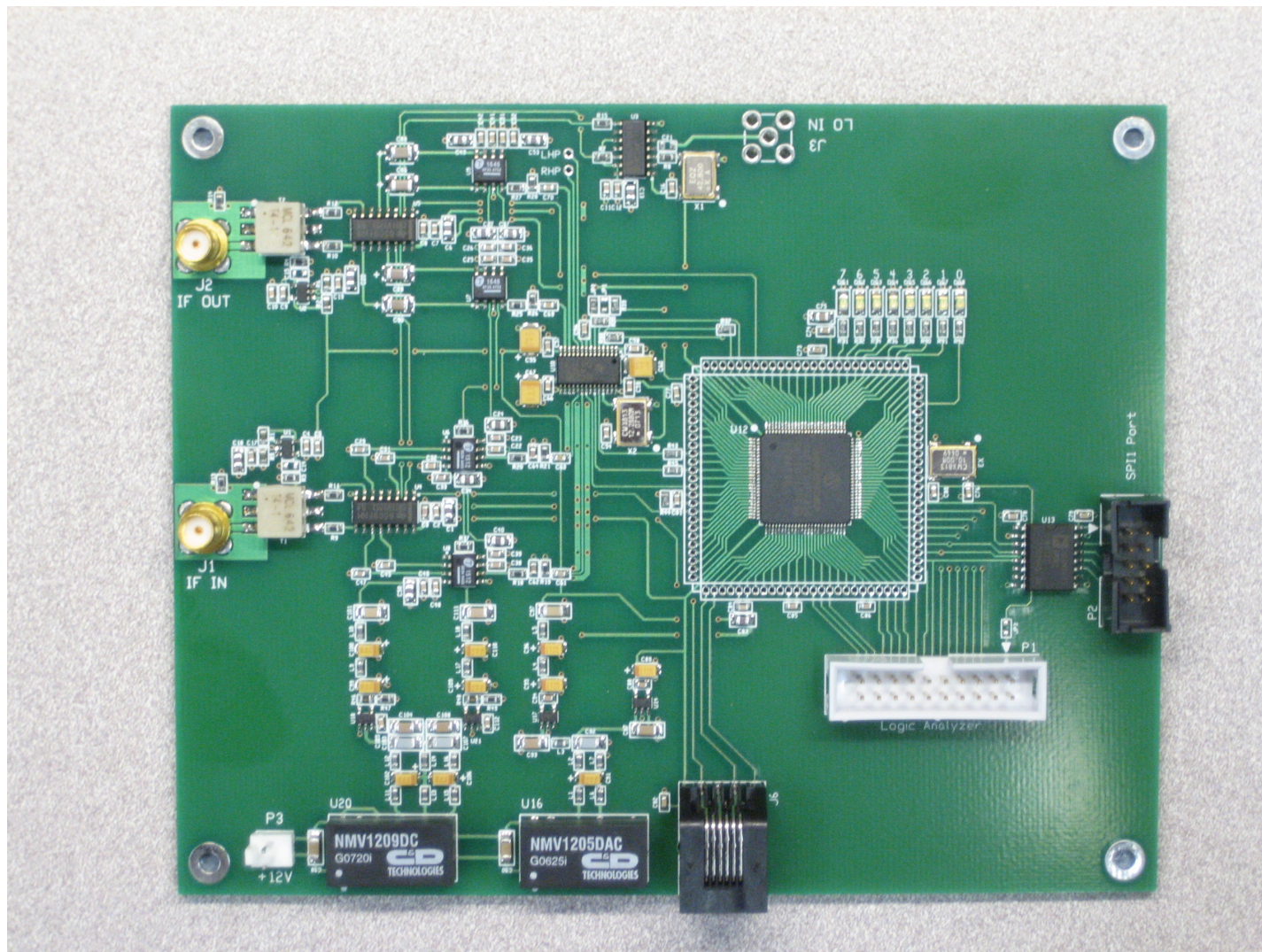


SuitSat-2 Software Defined Transponder (SDX) Block Diagram





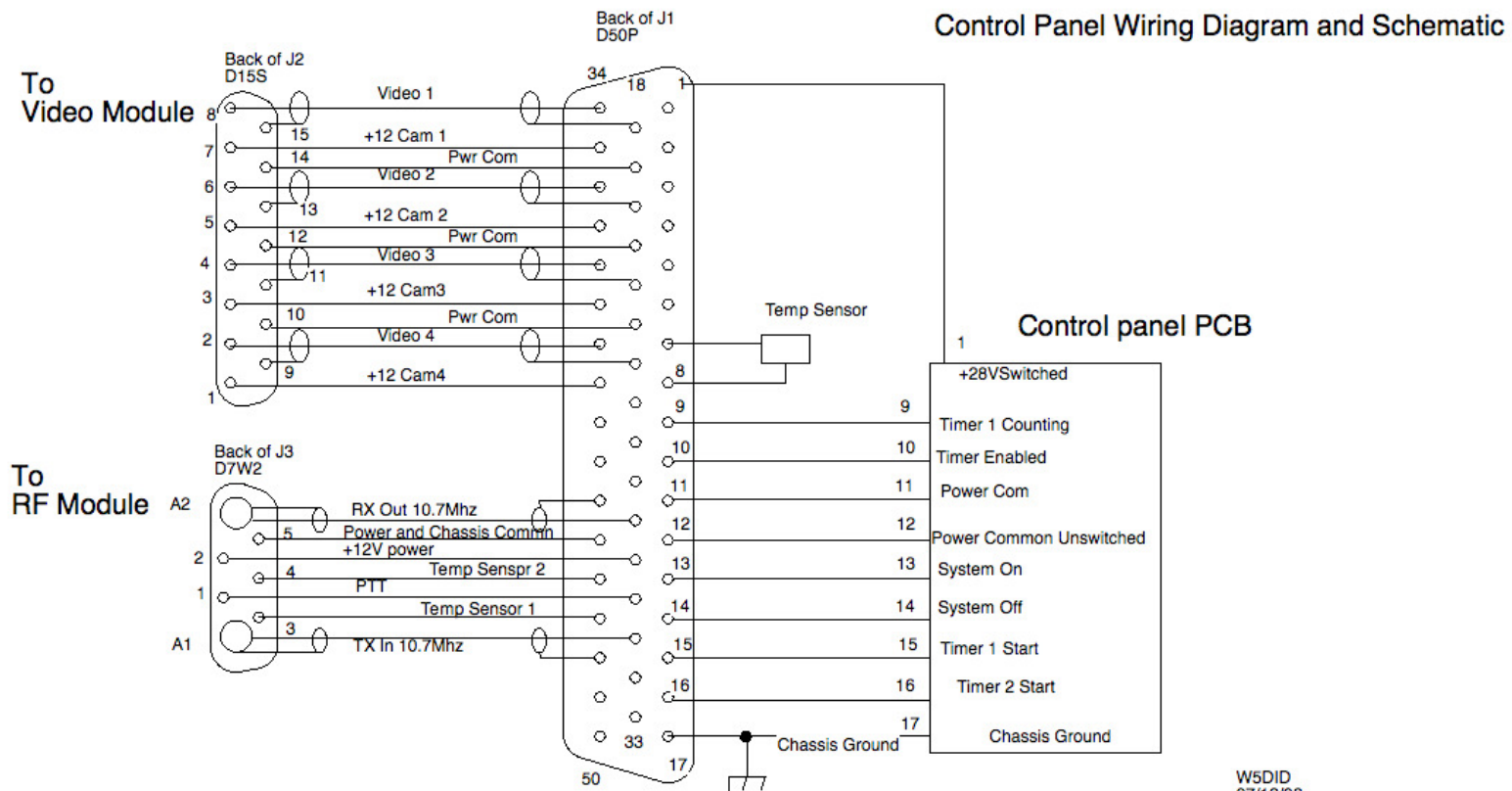
Suitsat 2 SDX



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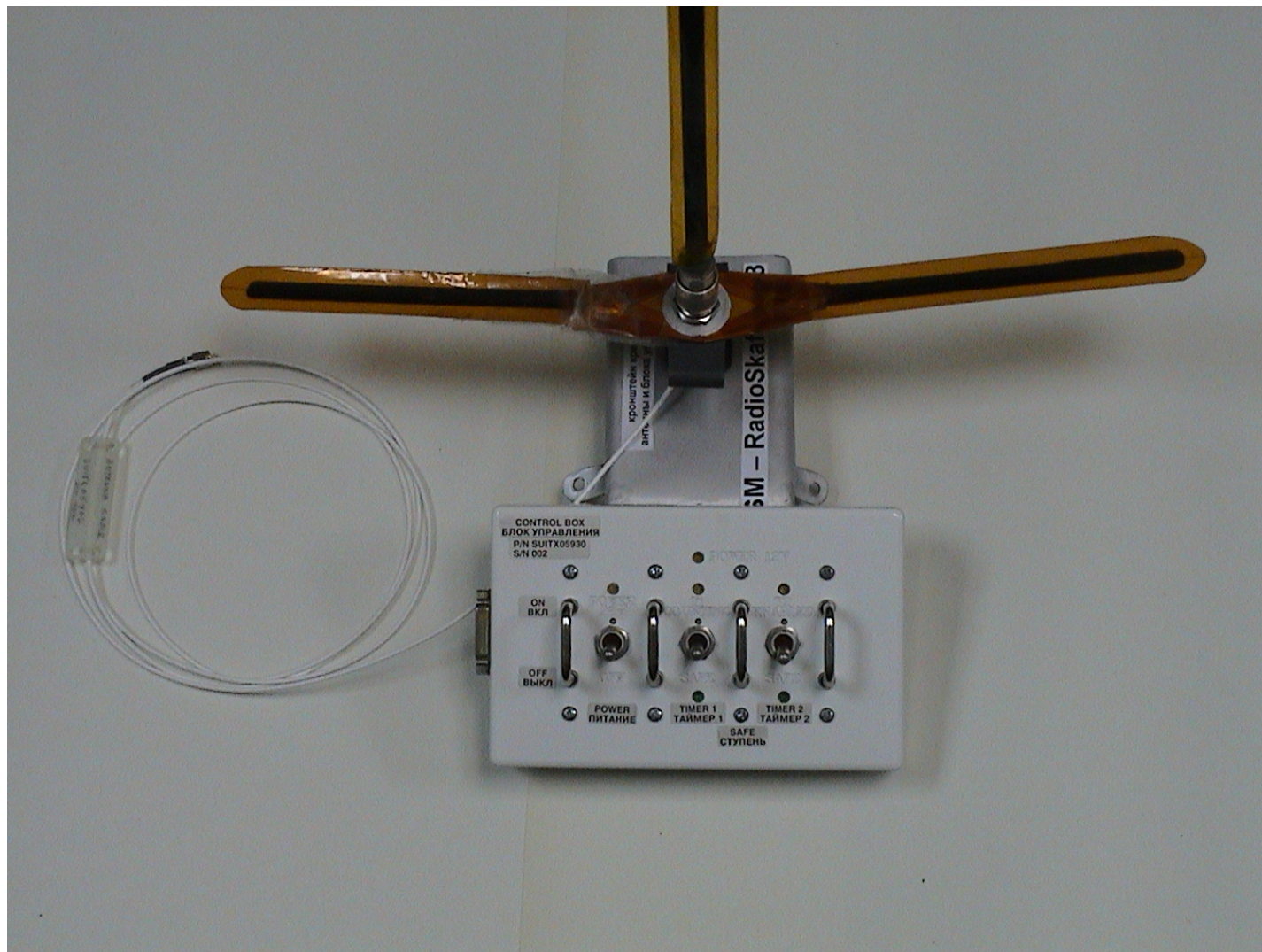
Suitsat 2 Control Panel



W5DID
07/12/08



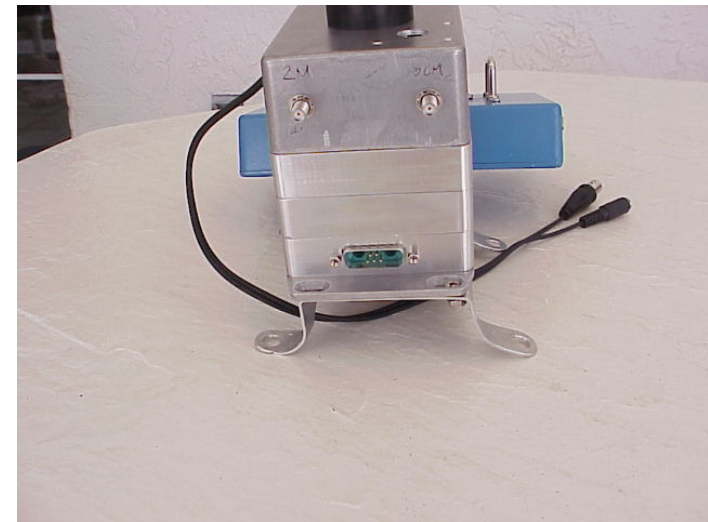
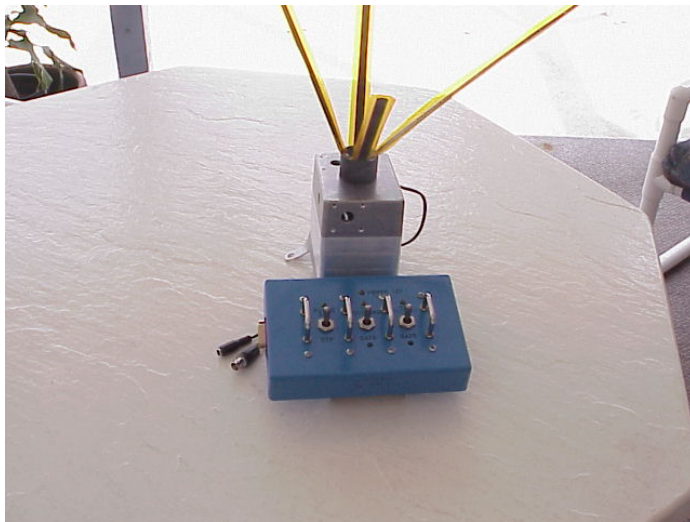
Suitsat 1 Antenna



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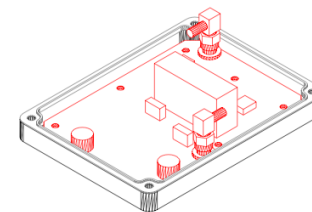
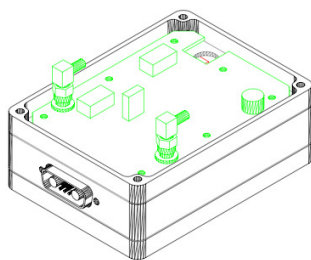
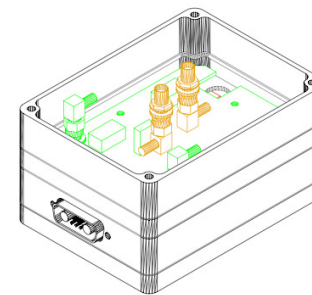
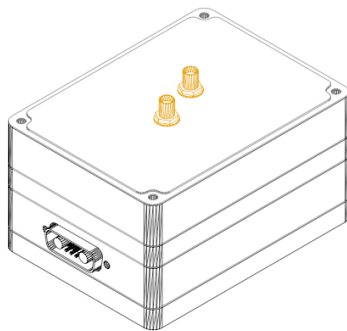
Suitsat 2 Antenna & RF assembly



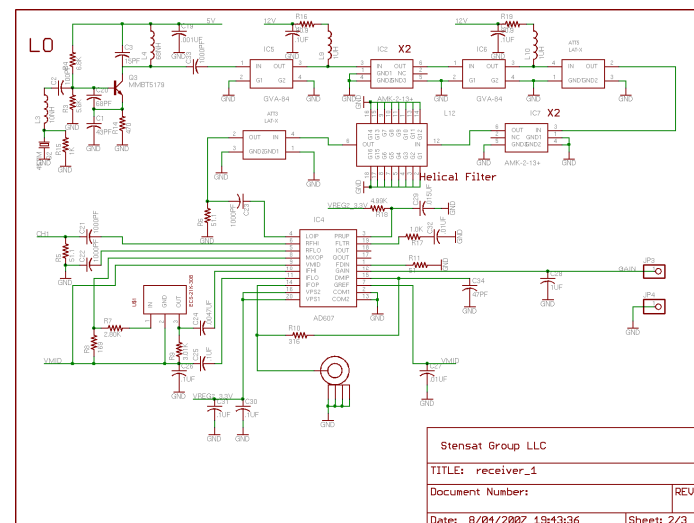
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RF Assembly

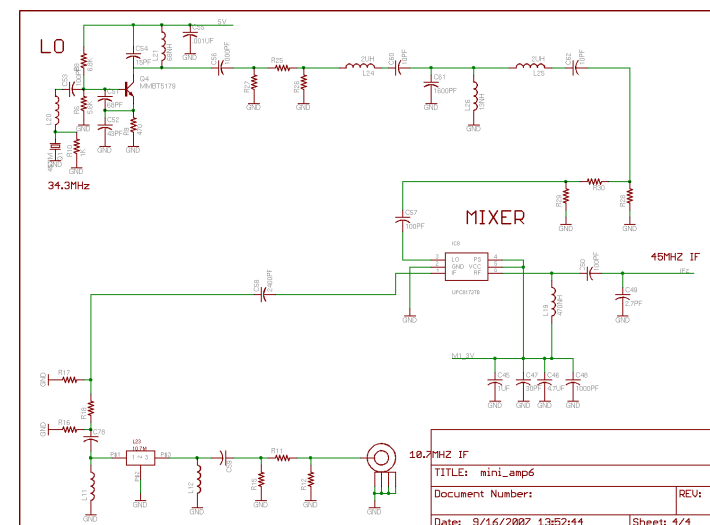
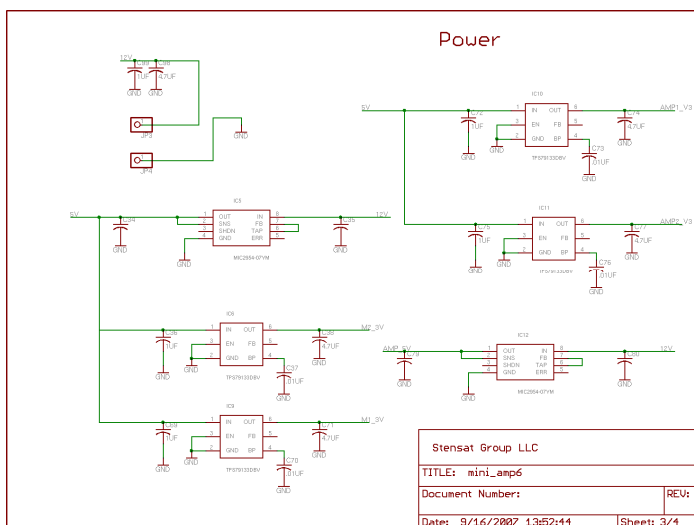
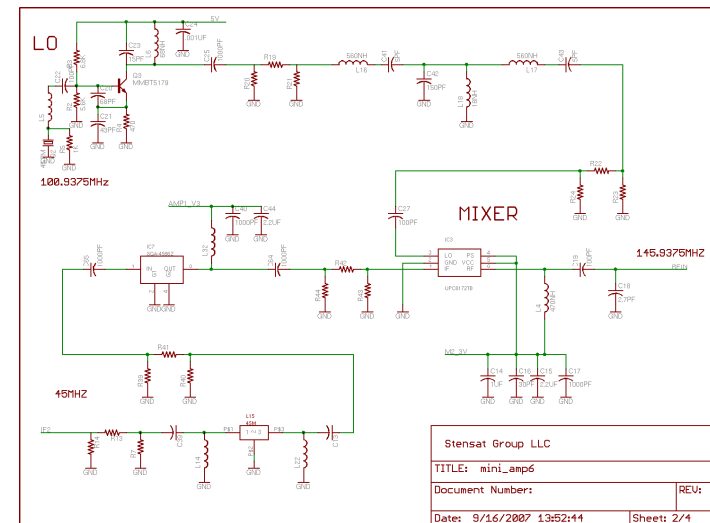
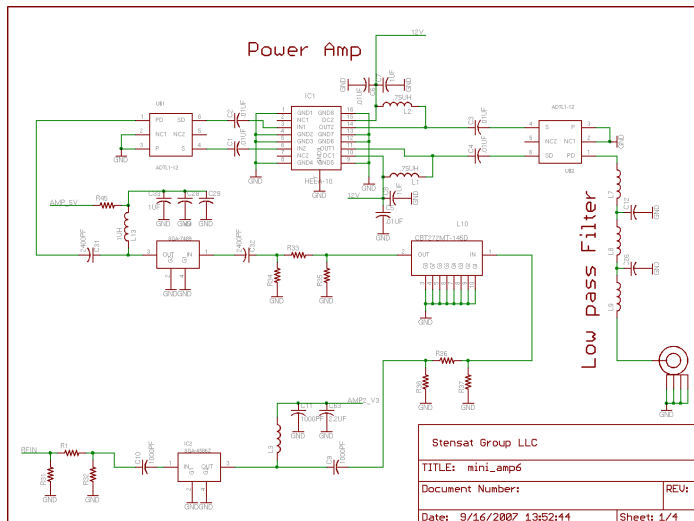


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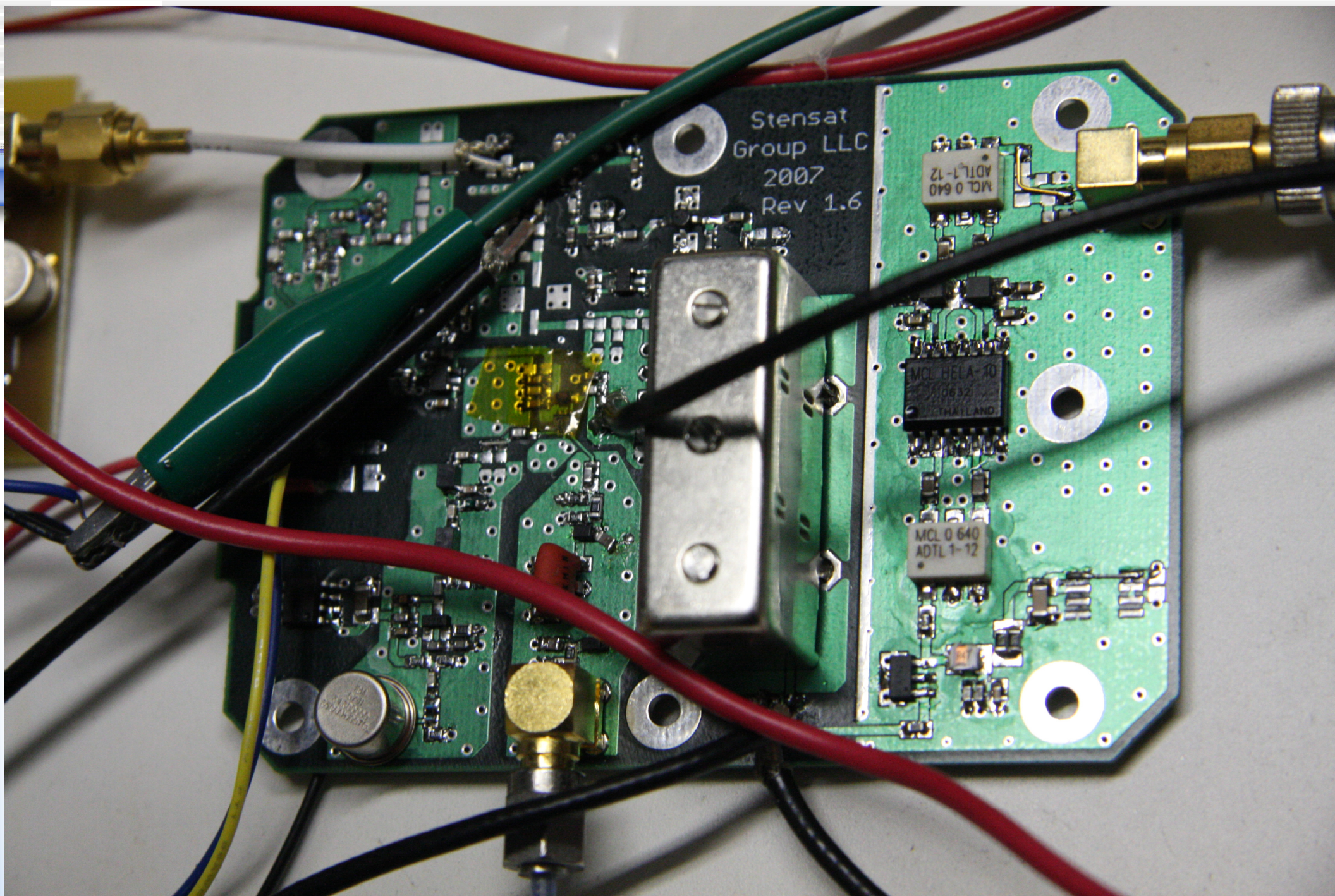




Suitsat 2 Transmitter

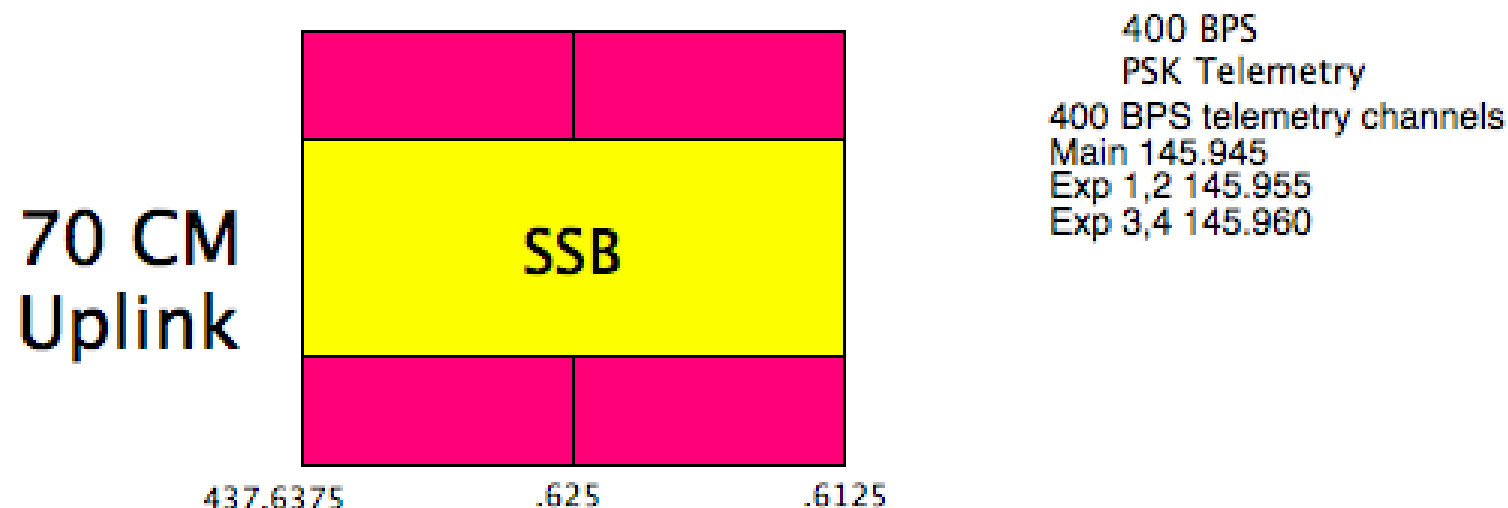
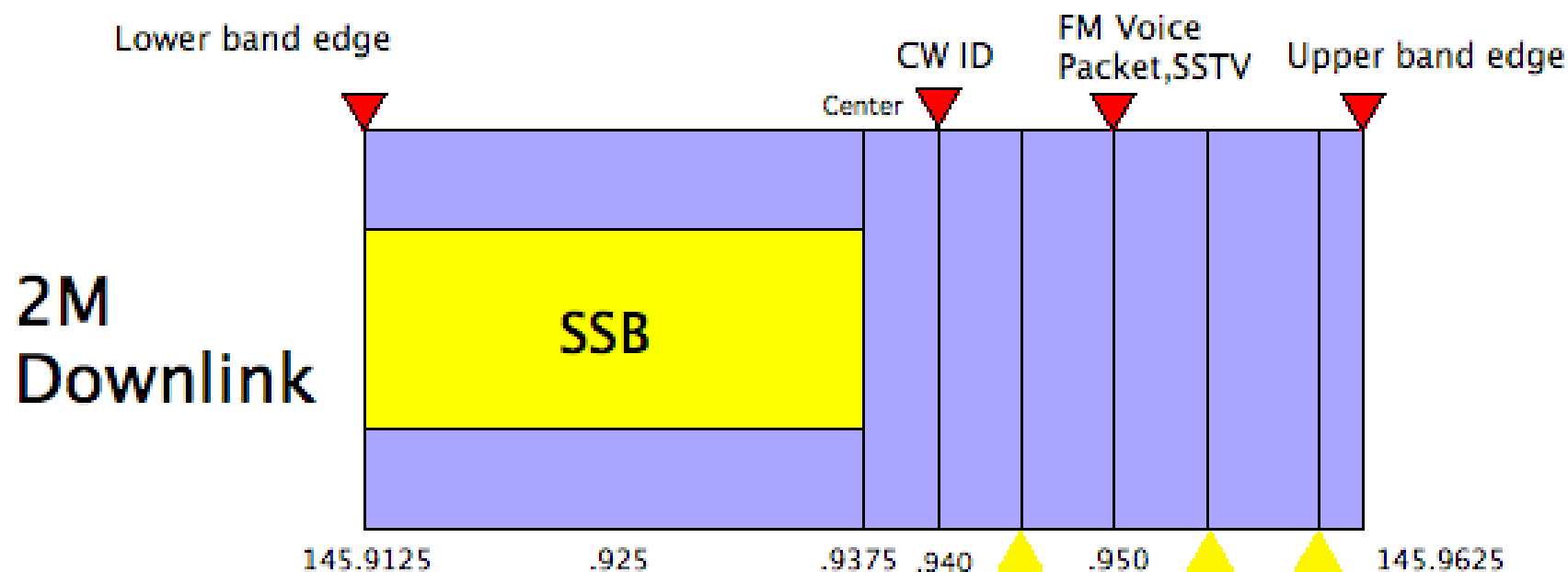


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Proposed Suitsat 2 Band Plan (REV C)



Downlink Frequency = 583.55 - Uplink frequency



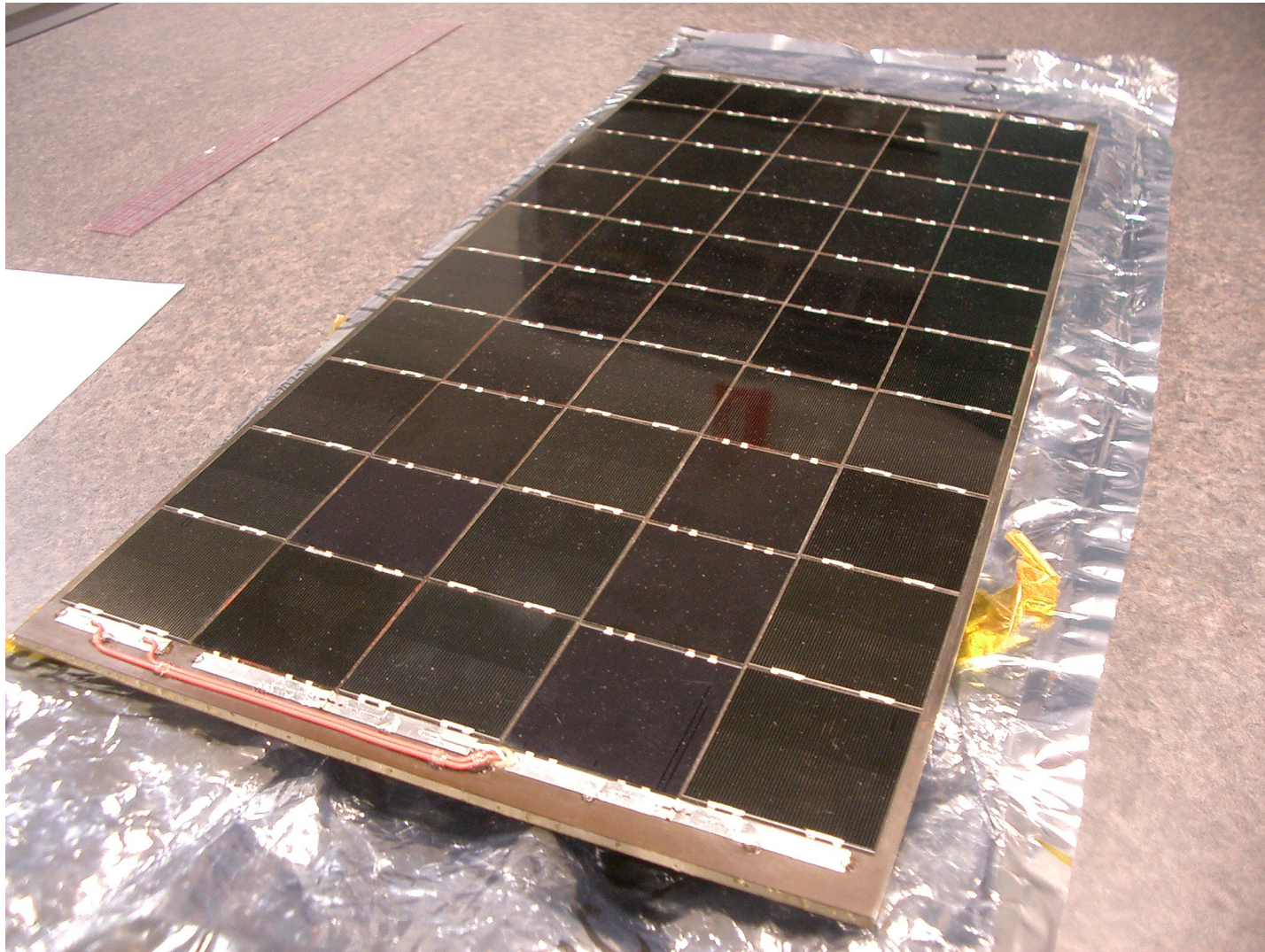
Solar Power System Plan



- NASA supplied.
- Surplus from previous NASA SMEX (SMAll EXplorer) satellite program.
- Power converter based on planned Eagle design.
- Designed to charge the surplus ISS Russian Space Suit batteries.



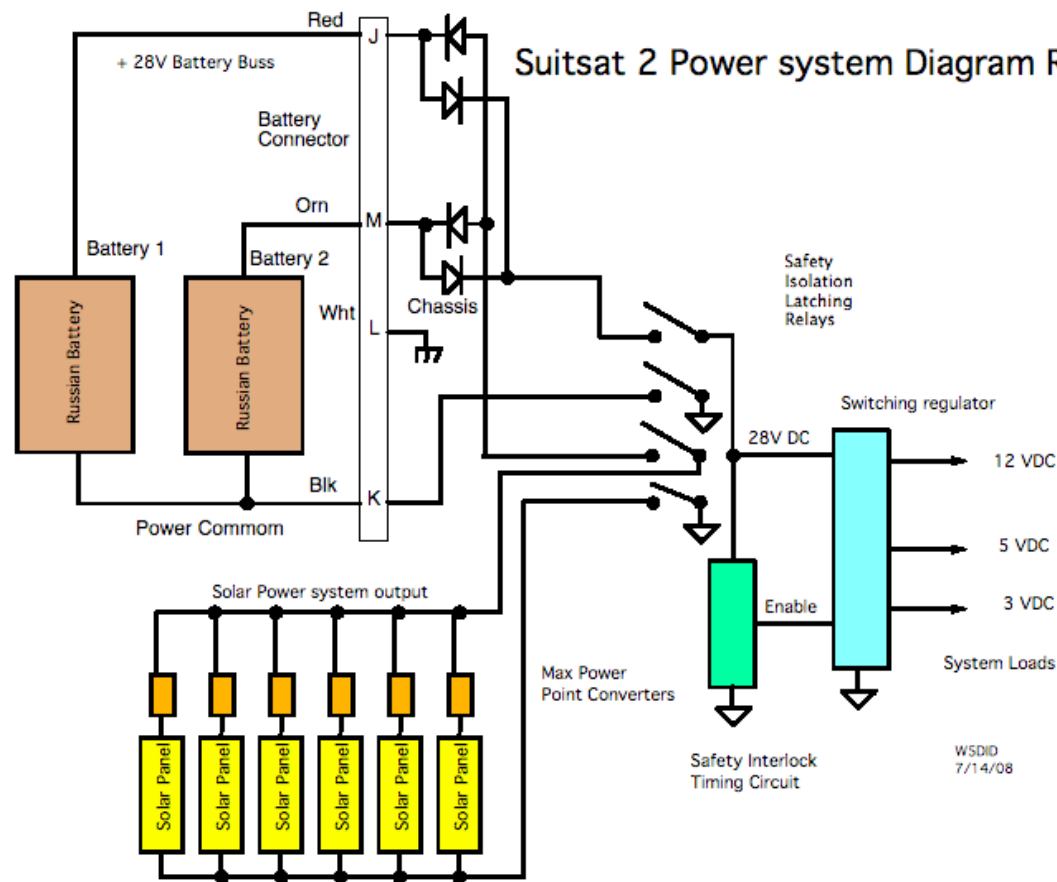
SMEX Solar Panel



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Power system will utilize two batteries

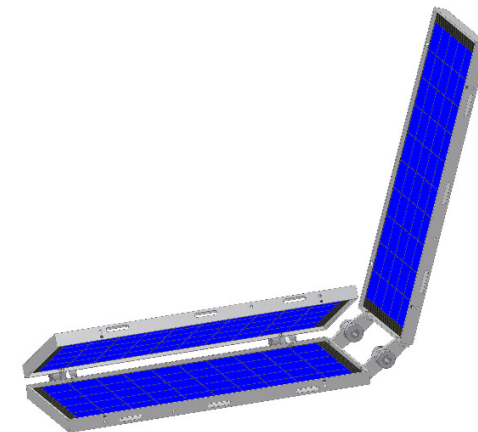




Suitsat 2 Solar Panel Assembly

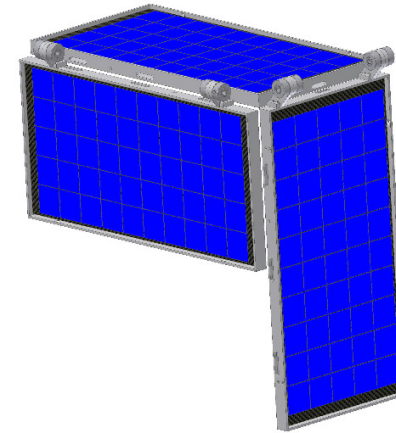


- SMEX Panel is mounted in hinged frame that is closed until deployed outside cabin.
- Panel secured closed by three two sided Velcro straps and attached to suit inside cabin.





Solar Panel Deployment proposals



- Solar panels to be attached to the leg / boot.



Scientific Experiments



- The ARISS team will work together to determine how to select the schools that will fly experiments on SuitSat-2.
- Four CCD cameras will take pictures and whichever one has the image will be encoded and transmitted to the ground. The formats available will be Martin, Scottie- 1 and Robot-36. Cameras have been identified, but have not yet been purchased and will need to be certified.



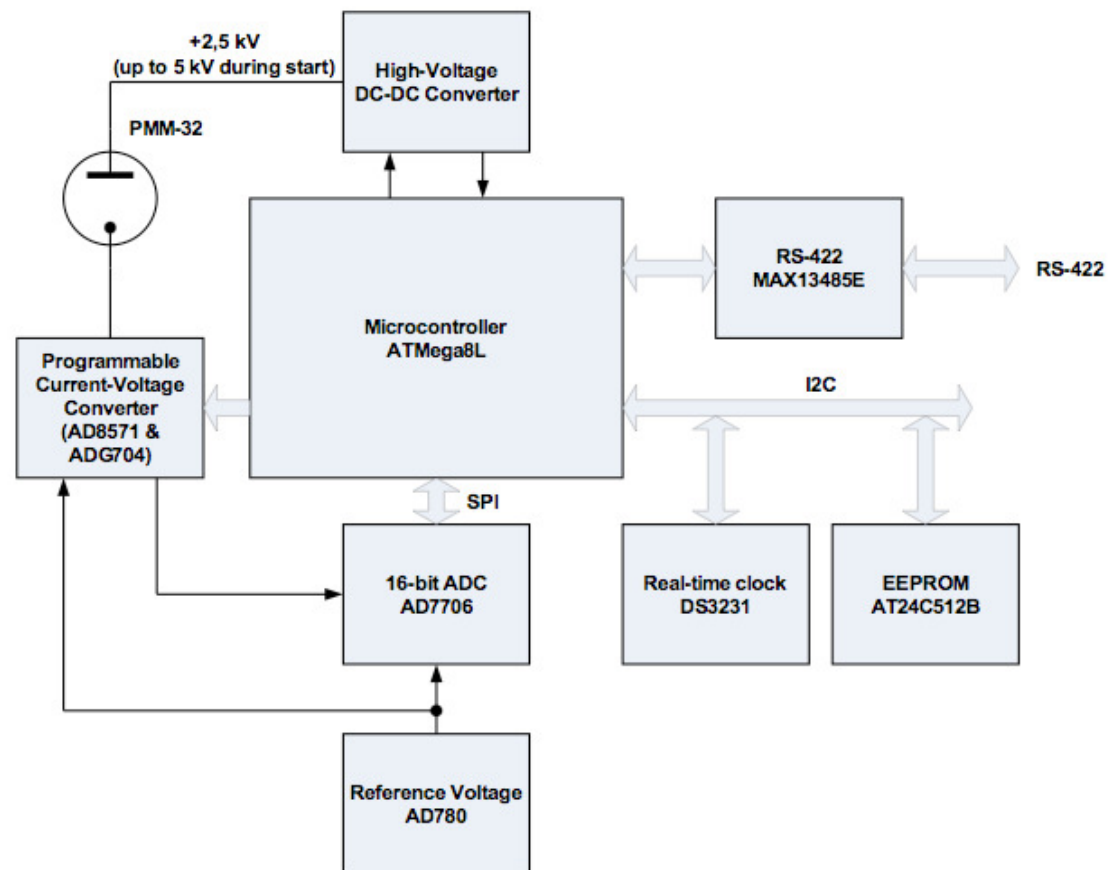
The Kursk University Experiment



- ☐ The experiment is designed to measure the unevenness of the vacuum atmosphere in the vicinity of the Suitsat 2
- ☐ It must be mounted so that it is exposed to the atmosphere outside the suit.
- ☐ It must send it's data to the ground via the Suitsat 2 telemetry system

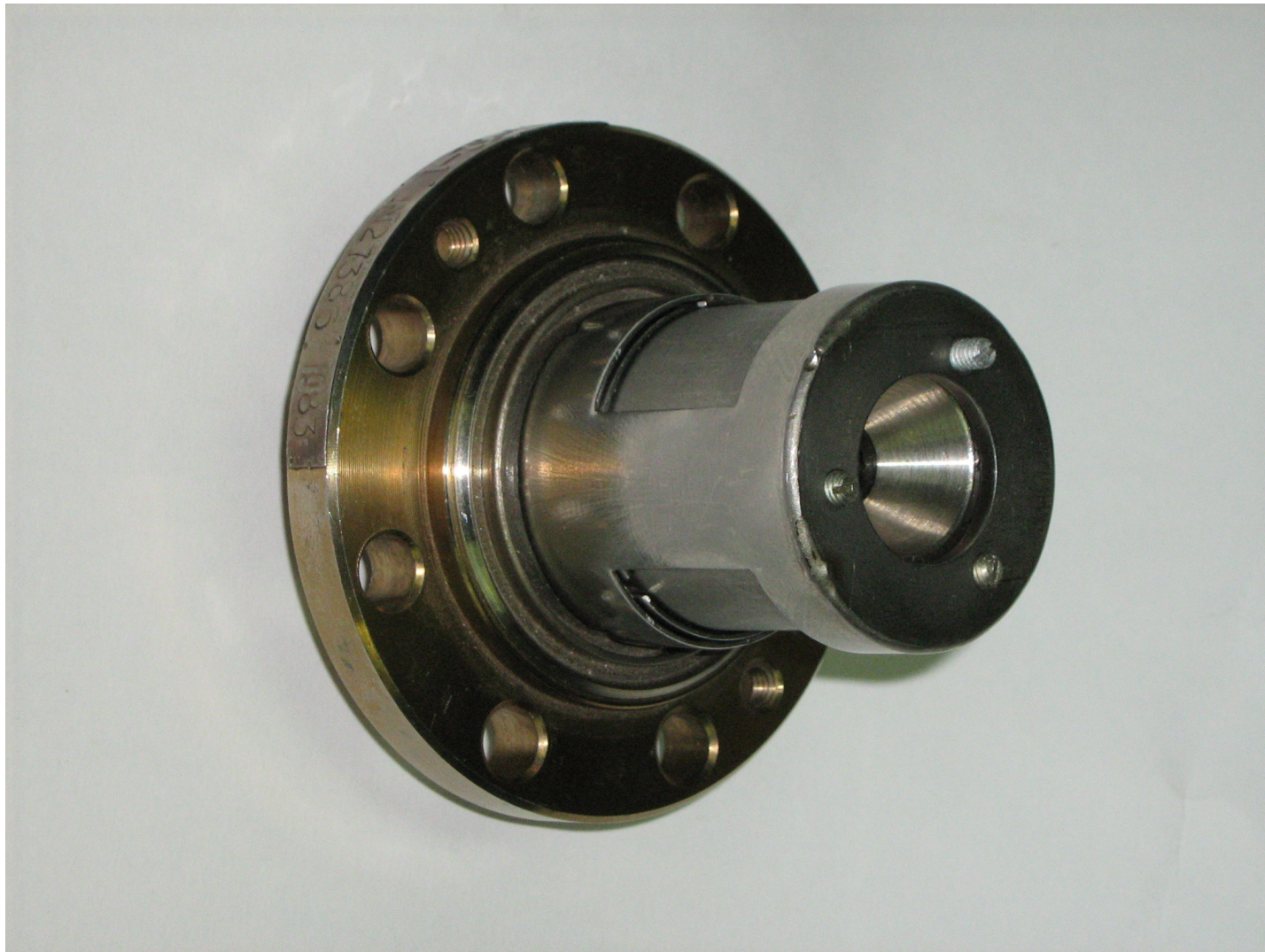


University of Kursk Experiment Block Diagram





Kursk Experiment Sensor



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Kursk team examining mounting possibilities



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Suitsat 2 Camera



200 Series



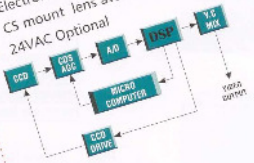
HTC-260

HTC-2M1

HTC-250

BOARD CAMERA

- Full digital process of BLC
- Auto Tracing White Balance
- 2H mode of H.V. aperture correction
- Digital process of color matrix
- Electronic Shutter up to 1/100,000
- CS mount lens available
- 24VAC Optional



```
graph LR; CCD[CCD] --> CODE[CODE APP.]; CODE --> AO[AO]; AO --> DSP[DSP]; DSP --> RS[RS MAX]; RS --> DATA[DATA OUTPUT]; CCD --> MICRO[MICRO COMPUTER]; MICRO --> AO; MICRO --> DRIVE[CCD DRIVE]; DRIVE --> CCD
```

BUILDING A NEW SECURE ERA

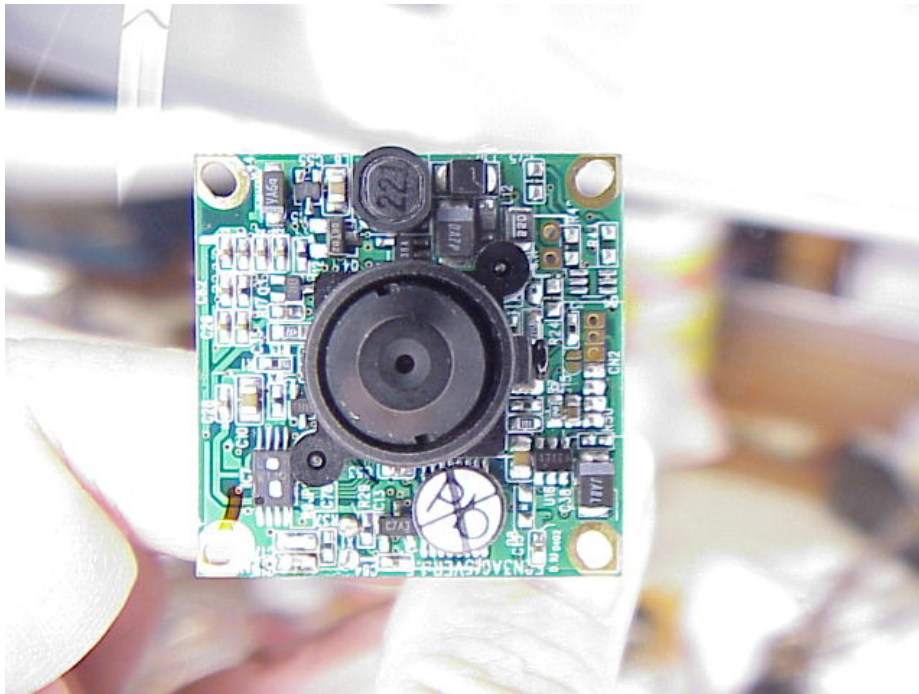


Digital Processing

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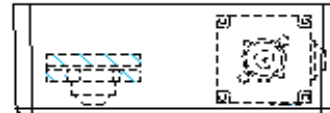
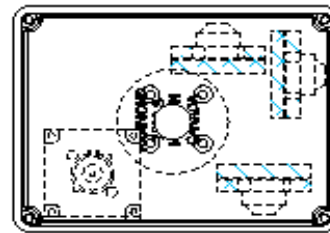
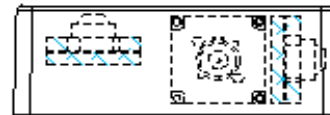


Hunt 2N323s Camera





Camera mount on helmet





Educational Outreach



- **Educational Outreach**

- Educational outreach activities will include:
 - CW call signs,
 - Suitsat website,
 - SSTV images,
 - CD of school photos to be flown on ISS,
 - voice messages and
 - media coverage.
- Rita Wright has developed Suitsat lesson plans for elementary schools, middle schools and High schools.
- Joe Julicher has worked with a scout troop building some of the Suitsat components.